DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al. (Japan Patent Application Pub. JP406276017) in view of Riza (U.S. Patent 5,187,487).

Regarding claim 1, Kobayashi et al. discloses in FIG. 3 an antenna feeding circuit. FIG. 3 comprises first optical demultiplexer 44_{11}, second optical demultiplexer 44_{13}, first optical frequency converter (frequency shifter) 49_1, second optical frequency converter 49_3, optical multiplexer 13, the output of which travel a single coaxial optical path, optical synthesizer 31, beam synthesizer 44 and a plurality of optoelectronic converters 52. The difference between Kobayashi et al. and the claimed invention is that Kobayashi et al. does not teach a spatial optical modulator. Riza teaches in FIG. 2 an apparatus for driving an antenna array. Riza teaches in FIG. 2 device 144 for controlling the beam width (equivalent to signal light emitting unit for converting the signal light into a signal light beam having a predetermined beam width) and spatial light modulator (SLM) 170 (equivalent to spatial optical modulator) for adjusting the phase of the beams before the beams are superimposed with a reference beam. Kobayashi et al. also teaches a similar approach by adjusting the reference beams which has equivalent effect of adjusting the frequency shifted beams. One of ordinary skill in the art would have been motivated to combine the teaching of Riza with the antenna feeding circuit of Kobayashi et al.

because the pixel array of the SLM corresponds to the antenna array so that a separate selectively phase delayed signal light beam is generated for each antenna element in the antenna array to be individually controlled. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a SLM for adjusting the phase of light beams, as taught by Riza, in the antenna feeding circuit of Kobayashi et al. because the pixel array of the SLM corresponds to the antenna array so that a separate selectively phase delayed signal light beam is generated for each antenna element in the antenna array to be individually controlled.

3. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al. and Riza as applied to claim 1 above, and further in view of Izadpanah et al. (U.S. Patent 7,020,396 B2) and Hong et al. (U.S. Patent 4,965,603).

Kobayashi et al. and Riza have been discussed above in regard to claim 1. Furthermore, Kobayashi et al. teaches in FIG. 3 Fourier transform lens 46 and optical transmission lines 48. It is well known in the art that fiber is a popular transmission line for optical signal. The difference between Kobayashi et al. and Riza and the claimed invention is that Kobayashi et al. and Riza teach phase modulation instead of intensity modulation. Izadpanah et al. teaches in FIG. 2 an optic-electronic ultra-wideband radio waveform generator. Izadpanah et al. teaches in FIG. 2 SLM 204 for modulating at least one of phase and amplitude. That is, Izadpanah et al. considers phase modulation and amplitude modulation provides equivalent function. Each of them may have minor difference from the other and more desirable for particular applications. Hong et al. provides another example of using amplitude modulation. Where the claimed differences involve the substitution of interchangeable or replaceable equivalents and the reason for the selection of one equivalent for another was not to solve an existent problem, such substitution has been

judicially determined to have been obvious. See In re Ruff, 118, USPQ 343 (CCPA 1958). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to replace phase modulation with intensity modulation.

Since Kobayashi et al. teaches Fourier transform lens 46 along the reference beams, the Examiner cites Hong et al. to teach that the Fourier transform lens can be placed along the modulated beam. Hong et al. teaches in FIG. 1 an antenna feeder comprising SLM 24 and Fourier transform lens 26. The references, considered as a whole, suggest that the SLM and Fourier transform lens can be placed along the reference beams or the modulated beams and provide equivalent effects. Choosing of one over the other is an engineering choice that is obvious to one of ordinary skill in the art. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to place a Fourier transform lens along the modulated beams.

4. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al. and Riza as applied to claim 1 above, and further in view of Bouzid et al. (U.S. Patent 6,038,076).

Kobayashi et al. and Riza have been discussed above in regard to claim 1. The difference between Kobayashi et al. and Riza and the claimed invention is that Kobayashi et al. and Riza do not teach the structure of the multiplexer. Bouzid et al. teaches in FIG. 1 a multiplexer comprising a first prism 31 and a second prism 24. One of ordinary skill in the art would have been motivated to combine the teaching of Bouzid et al. with the modified antenna feeding circuit of Kobayashi et al. and Riza because the prisms of Bouzid et al. are oriented to operate at or near Brewster's angles, so that insertion loss is minimal. Thus it would have been obvious to

one of ordinary skill in the art at the time the invention was made to use two prisms to form a multiplexer, as taught by Bouzid et al., in the modified antenna feeding circuit of Kobayashi et al. and Riza because the prisms of Bouzid et al. are oriented to operate at or near Brewster's angles, so that insertion loss is minimal.

5. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al. and Riza as applied to claim 1 above, and further in view of Takushima et al. (U.S. Patent 6,810,170 B2).

Kobayashi et al. and Riza have been discussed above in regard to claim 1. The difference between Kobayashi et al. and Riza and the claimed invention is that Kobayashi et al. and Riza do not teach the structure of the multiplexer. Takushima et al. teaches multiplexers. In particular, Takushima et al. teaches in FIG. 5 a multiplexer comprising a first diffraction grating 221 and second diffraction grating 211 and a single coaxial optical path 90. One of ordinary skill in the art would have been motivated to combine the teaching of Takushima et al. with the modified antenna feeding circuit of Kobayashi et al. and Riza because the each wavelength in the multiplexer has a different optical path length and chromatic dispersion in these light components can be adjusted. Furthermore, the optical fibers 90 to 94 having no collimator function can be used; hence the multiplexer can be inexpensive. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the multiplexer of Takushima et al. in the modified antenna feeding circuit of Kobayashi et al. and Riza because the each wavelength in the multiplexer has a different optical path length and chromatic dispersion in these light components can be adjusted.

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al., Riza and Izadpanah et al. as applied to claim 2 above, and further in view of Takushima et al. (U.S. Patent 6,810,170 B2).

Kobayashi et al., Riza and Izadpanah et al. have been discussed above in regard to claim 1. The difference between Kobayashi et al., Riza and Izadpanah et al. and the claimed invention is that Kobayashi et al., Riza and Izadpanah et al. do not teach the structure of the multiplexer. Bouzid et al. teaches in FIG. 1 a multiplexer comprising a first prism 31 and a second prism 24. One of ordinary skill in the art would have been motivated to combine the teaching of Bouzid et al. with the modified antenna feeding circuit of Kobayashi et al., Riza and Izadpanah et al. because the prisms of Bouzid et al. are oriented to operate at or near Brewster's angles, so that insertion loss is minimal. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to use two prisms to form a multiplexer, as taught by Bouzid et al., in the modified antenna feeding circuit of Kobayashi et al., Riza and Izadpanah et al. because the prisms of Bouzid et al. are oriented to operate at or near Brewster's angles, so that insertion loss is minimal.

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kobayashi et al., Riza and Izadpanah et al. as applied to claim 2 above, and further in view of Takushima et al. (U.S. Patent 6,810,170 B2).

Kobayashi et al., Riza and Izadpanah et al. have been discussed above in regard to claim 2. The difference between Kobayashi et al., Riza and Izadpanah et al. and the claimed invention is that Kobayashi et al., Riza and Izadpanah et al. do not teach the structure of the multiplexer. Takushima et al. teaches multiplexers. In particular, Takushima et al. teaches in FIG. 5 a

multiplexer comprising a first diffraction grating 221 and second diffraction grating 211 and a single coaxial optical path 90. One of ordinary skill in the art would have been motivated to combine the teaching of Takushima et al. with the modified antenna feeding circuit of Kobayashi et al., Riza and Izadpanah et al. because the each wavelength in the multiplexer has a different optical path length and chromatic dispersion in these light components can be adjusted. Furthermore, the optical fibers 90 to 94 having no collimator function can be used; hence the multiplexer can be inexpensive. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the multiplexer of Takushima et al. in the modified antenna feeding circuit of Kobayashi et al., Riza and Izadpanah et al. because the each wavelength in the multiplexer has a different optical path length and chromatic dispersion in these light components can be adjusted.

Response to Arguments

8. Applicant's arguments filed 16 February 2010 have been fully considered but they are not persuasive.

The Applicant argues "Although Riza discloses a spherical lens 142 centered between two light beam clusters emanating from an acousto-optic modulator (AOM) 140, the output beams are not directly, inputted to the spatial light modulator 170. Rather, the spherical lens 142 converts the diverging wavefronts of the light beams in reference beam cluster b+1 and signal beam cluster b to collimated beam clusters. The reference beam cluster b+1 is inputted to a 45o prism 145 and the signal beam cluster b is inputted to a 90 degree polarization rotator 143. (See col. 7, line 55 - col. 8, line 25.) None of the reference beam cluster b+l and the signal bema

cluster b is directly inputted to the spatial modulator 170." However, beam b' in FIG. 2 of Riza is directly coupled to spatial optical modulator 170.

The Applicant argues "Kobayashi clearly discloses that multiplexing is carried out and it is led to two or more optical transmission lines. (See paragraphs [0031] and [0033].) Thus, in Kobayashi, the multiplexer 13 outputs a plurality of light beams to travel through different optical paths." The Examiner disagrees. FIG. 3 of Kobayashi clearly teaches that the multiplexer 13 has a single output to lens 43_3. The "two or more optical transmission lines" mentioned in paragraphs [0031] and [0033] refer to the fiber bundle 48.

9. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., Koybayashi's antenna feeder cannot direct a plurality of beams in a same direction or cannot superimpose) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shi K. Li whose telephone number is 571 272-3031. The examiner can normally be reached on Monday-Friday (6:30 a.m. - 4:00 p.m.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Vanderpuye can be reached on 571 272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

skl
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/Shi K. Li/
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